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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/560,812 | OBWEGER ET AL. | |
| | Examiner | Art Unit | |
| | NAOMI BIRBACH | 4132 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 December 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12152005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Specification*

1. The disclosure is objected to because of the following informalities: In many instances, commas are present in numerical values instead of decimal points.

Appropriate correction is required.

2. The possible attempt to incorporate subject matter into this application by reference to USPN 4,903,717, USPN 5,788,453, and USPN 5,156,174 on Page 9 of the specification is ineffective because the specification is missing the root words "incorporate" and "reference".

3. The incorporation by reference will not be effective until correction is made to comply with 37 CFR 1.57(b), (c), or (d). If the incorporated material is relied upon to meet any outstanding objection, rejection, or other requirement imposed by the Office, the correction must be made within any time period set by the Office for responding to the objection, rejection, or other requirement for the incorporation to be effective. Compliance will not be held in abeyance with respect to responding to the objection, rejection, or other requirement for the incorporation to be effective. In no case may the correction be made later than the close of prosecution as defined in 37 CFR 1.114(b), or abandonment of the application, whichever occurs earlier.

4. Any correction inserting material by amendment that was previously incorporated by reference must be accompanied by a statement that the material being inserted is the material incorporated by reference and the amendment contains no new matter. 37 CFR 1.57(f).

***Claim Objections***

5. The claims are objected to because the lines are crowded too closely together, making reading difficult. Substitute claims with lines one and one-half or double spaced on good quality paper are required. See 37 CFR 1.52(b).

6. Claim 3 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 3 recites “wherein means for rotating at least one of said two plates.” Claim 3 depends from claim 1, which already claimed "rotating means for rotating said second plate." Therefore, claim 3 repeats the subject matter of the previous claim rather than further limiting it.

7. Claim 5 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 5 recites “gripping means” Claim 5 depends from claim 1, which already claimed "holding means," which are defined by the specification to be gripping means. Therefore, claim 5 repeats the subject matter of the previous claim rather than further limiting it.

8. Claim 6 is objected to because of the following informalities: the phrase "wherein second plate" is missing the word "said" or "the" in front of "second plate. Appropriate correction is required.

9. Claims 10 and 11 are objected to because of the following informalities: the numerical values contain commas instead of decimal points. Appropriate correction is required.

10. Claims 10 and 11 are objected to because of the following informalities: The claim recites “during treating the wafer", which is grammatically incorrect. It should recite “during treatment of the wafer” or “while treating the wafer." Appropriate correction is required.

11. Claim 19 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 19 recites “wherein the wafer is rotating.” Claim 19 depends from claim 18, which already claimed "relatively rotating wafer." Therefore, claim 19 does not further limit the subject matter of the previous claim.

12. Claim 22 is objected to because of the following informalities: The claim must be in one sentence form only. The phrase “adjustment-elements are provided in order to direct ultrasonic waves at an angle ά of less than 89° to a wafer when treated” is a second sentence. Appropriate correction is required.

13. Claim 31 is objected to because of the following informalities: The claim is missing the words “further comprising” or “wherein” to further limit the device according to claim 22. Appropriate correction is required.

14. Claim 37 is objected to because of the following informalities: The claim is missing the word "by" in the phrase "is generated an array of" in line 3 of the claim. It should say "is generated by an array of". Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

15. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

16. Claims 5, 6, 8, 10, 11, 14, 17, 25, 33 and 35 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

17. Claim 5 recites the limitation “gripping means” which depends from claim 1, which recites “holding means.” According to the specification, “holding means” are defined as “gripping means.” This claim is therefore indefinite because it is unclear if dependent claim 5 is modifying independent claim 1.

18. Claim 6 recites the limitation “wherein second plate is not rotatable.” Claim 6 depends from Claim 1 which claimed "rotating means for rotating said second plate." This claim is therefore indefinite because it negates the previous claim.

19. Claim 8 recites the limitation "said liquid collector" in lines 1-2 of the claim. There is insufficient antecedent basis for this limitation in the claim.

20. Claims 10 and 11 recite the limitation “spacer means.” However, both “spacer means” and “holding means" of claim 1 are defined by the specification to be “gripping means.” This claim is indefinite because it is unclear whether dependent claims 10 and

11 are adding additional gripping means or simply imparting additional function to the holding means.

21. Claim 11 recites the limitation "second spacer means" in line 1. There is insufficient antecedent basis for this limitation in the claim, as a first spacer means has not been claimed.

22. Claim 17 recites the limitation “having a specific sound-propagation velocity deferring not more to the specific sound-propagation velocity of water.” It is unclear what is meant by the word choice of deferring, rendering this claim indefinite. In addition, the phrasing is further confused by the specification which describes aluminum, a preferred material, as having a specific sound propagation greater than that of water.

23. Claim 25 recites the limitation “a liquid circuit.” This claim is indefinite since is unclear what is intended by this term, as it is not a term of the art and it is not explained in applicant's specification.

24. Claim 33 recites the limitation "the second plate" in line 3. There is insufficient antecedent basis for this limitation in the claim.

25. Claim 35 recites the limitation "the second plate" in line 2. There is insufficient antecedent basis for this limitation in the claim.

26. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). Note the explanation given by the Board

of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949). In the present instance, claims 10 and 11 recite the broad recitation “0.1 mm to 10 mm”, and the claims also recite “0.5 mm to 5 mm” which is the narrower statement of the range/limitation.

### ***Claim Rejections - 35 USC § 103***

27. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

28. Claims 1-11, 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over USPN 6,632,292 to Aegerter et al. in view of USPA 2002/0050244 to Engesser and US 2002/0162570 to Cavazza.

29. As to claims 1, 2, 3, 4 and 5, Aegerter discloses an apparatus for wet-treating a wafer comprising a first plate (Ref. #138) and a second plate (Ref. #144) substantially parallel to the first plate and horizontally arranged (Col. 10, lined 41-42; Figure 4). A first

dispensing means for introducing a fluid into a first gap between said first plate and a wafer when being treated is provided in the form of a fluid supply tube (Ref. #156) with a fluid outlet nozzle (Ref. #158) (Col. 10, lines 56-60; Figure 4). The fluid supply tube extends centrally through the axis of rotation (Col. 10, lines 60-61). This structure is in accordance with the dispenser as described by applicant's specification. A second dispensing means is similarly provided to introduce fluid into a second gap between said second plate and a wafer being treated comprising a fluid supply tube (Ref. #160) and inlet (Ref. #148) (Col. 10, lines 62-64; Figure 10). Aegerter discloses rotating means in the form of a rotor (Ref. #115) and rotor motor assembly (Ref. #124), in accordance with applicant's specification, for rotating the work piece housing, which includes the wafer and second plate, relative to each other about an axis substantially perpendicular to the second plate (Col. 9, lines 62—Col. 10, line 14; Figure 4).

30. According to the specification, holding means are defined as gripping means. The specification further defines gripping means as comprising movable gripping pins. Aegerter discloses wafer support members (Ref. #240) for clamping the wafers (Col. 12, lines 44-55) in the form of fasteners (Ref. #307) for holding a wafer between said first and seconds plates, substantially parallel to said plates (Col. 9, lines 52-60; Figure 1). Aegerter does not expressly disclose gripping pins in accordance with the specification. Aegerter also does not expressly disclose that the holding means and first plate are coupled to each other to form a holding unit. Aegerter does not expressly disclose at least one vibrating element acoustically coupled to at least said second plate.

28. Engesser discloses gripping means in the form of gripping pins which are movable through a mechanism (Page 3, Paragraph [0039]). The gripping pins are mounted to a mask, which corresponds to the shape of the wafer to be cleaned, and does not touch the wafer such that a gap remains, so it is understood to be applicant's claimed plate (Page 1, Paragraph [0013], [0015]). The gripping pins mounted to the plate comprise a holding unit as claimed.

29. Cavazza discloses a transducer that generates ultrasonic vibrations to clean a substrate facing downward (Page 1, Paragraphs [0011]-[0015]; Page 3, Paragraph [0032]). A working surface directed upward and placed under the substrate, which is applicant's claimed second plate, is mechanically connected to the ultrasound transducer (Page 1, Paragraphs [0011]-[0015]), and therefore is acoustically coupled.

30. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the apparatus taught by Aegerter to include gripping pins and to couple the holding means and first plate to form a holding unit as taught by Engesser in order to hold the wafer. One of ordinary skill would have been motivated to use gripping pins to insure that the wafer is securely held in place during cleaning.

31. It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the apparatus taught by Aegerter and Engesser to include a vibrating element acoustically coupled to the second plate as taught by Cavazza in order to improve cleaning of the wafer. Cavazza teaches that due to the ultrasonic vibration, no particle can remain sufficiently strongly attached to the face to be treated so as to resist the liquid and gravity (Page 1, paragraph [0008]).

32. As to claim 6, Aegerter does not expressly disclose that the second plate is not rotatable.

33. Engesser discloses a device for wet cleaning a wafer where the mask (i.e. plate) is held stationary (Page 2, Paragraph [0020]). The mask corresponds to the shape of the wafer to be cleaned, and does not touch the wafer such that a gap remains, so it is understood to be applicant's claimed plate (Page 1, Paragraph [0013], [0015]). While Engesser only discloses one plate, it is apparent that either the first or second plate as taught by Kim could be held stationary.

34. It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the apparatus taught by Aegerter to include a second plate that is not rotatable as taught by Engesser. One of ordinary skill would have been motivated to make this modification which is advantageous when the liquid between the plate and wafer should experience as little motion in itself as possible, thereby preventing it from reaching an area which is not to be treated by it (Page 2, Paragraph [0020]).

35. As to claims 7 and 8, Aegerter further discloses that a cup (liquid collector) may be disposed about the apparatus, including said holding means, for collecting used processing liquids (Col. 11, lines 22-25). It is understood that if the liquid collector is disposed about the apparatus, the plates are sealed to the liquid collector such that liquid flows into the collector without being lost.

36. As to claim 9, Aegerter does not expressly disclose means for varying distance as defined by applicant's specification to be hydraulic, pneumatic, or electromechanical elements, such as a belt drive or a ball spindle.

37. Engesser discloses distance changing means in the form of a pneumatic cylinder or a spindle (Page 3, Paragraph [0041]).

38. It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the apparatus taught by Aegerter to include means for varying distance as taught by Engesser (Page 3, Paragraph [0041]). One of ordinary skill would have been motivated to add means for varying distance so that the gap between the plate and the wafer can varied to insert and remove a wafer.

39. As to claims 10 and 11, Aegerter discloses spacing members to grip the wafer (Col. 10, lines 47-52), but does not discloses that these spacing means are for keeping the first or second plate and the holding means in certain distance while treating the wafer to form a gap between the wafer and the first plate of 0.1 to 10mm, and preferably 0.5 mm to 5 mm while treating the wafer. In accordance with applicant's specification, spacer means are defined as gripping pins.

40. Engesser discloses spacer means for keeping a mask and a wafer-shaped article at a distance of about 0.05 to 1 mm to each other (Page 2, Paragraph [0018]). The wafer shaped article is held by holding means (Page 1, Paragraph [0014]) so it is understood that the holding means are held at this distance as well. The mask corresponds to the shape of the wafer to be cleaned, and does not touch the wafer such that a gap remains between them, so it is understood to be equivalent to

applicant's claimed plate (Page 1, Paragraph [0013], [0015]). Engesser teaches that the spacer means consist of gripper elements such as pins (Page 2, Paragraph [0019]). It is understood that this spacer means could be attached to the first plate or the second plate.

41. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the apparatus taught by Aegerter to include spacer means as taught by Engesser in order to allow liquid to flow between the wafer and the plate. One of ordinary skill would have been motivated to add spacer means so that thin liquids can be prevented from running out of the capillary area between the plate and the wafer (Page 2, Paragraph [0018]).

42. As to claim 13, Aegerter further discloses an additional gas dispenser for the first gap (Col. 23, lines 31-34).

43. As to claim 14, Aegerter further discloses outlets, which are openings, in each of the plates that are spaced from each respective inlet. Since each inlet is located in the center of the plate, which is the rotational center, the spacing means that the outlets do not include the rotational center (Page 10, lines 65-66).

44. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over USPN 6,632,292 to Aegerter et al. in view of USPA 2002/0050244 to Engesser and US 2002/0162570 to Cavazza as applied to claim 1 above, and further in view of USPN 6, 890,390 to Azar

45. Aegerter, Engesser, and Cavazza are relied upon as discussed above with respect to the rejection of Claim 1.

46. As to claim 12, the combination of Aegerter, Engesser, and Cavazza does not expressly disclose that the vibrating element is arranged with respect to the second plate facing the wafer such that the ultrasonic waves are substantially directed to the wafer when treated taking an angle of 85-60 degrees to the plane provided for the wafer.

47. Azar discloses an ultrasonic cleaning system where the transducers are oriented at a steering angle, $\Theta_s$ which can be modified. The example steering angle provided is thirty degrees, meaning that the ultrasonic waves are directed to the wafer at an angle of sixty degrees (Col. 5, lines 40-45; Figure 6).

48. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method taught by Aegerter, Engesser, and Cavazza to include transducers oriented such that the ultrasonic waves are directed towards the second plate at 60-85 degrees as taught by Azar for the benefit of producing maximum acoustic intensity to improve cleaning. Furthermore, since the general conditions the claims are disclosed in the prior art, these optimum or workable ranges could be determined by routine experimentation. (MPEP 2144.05 A).

49. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over USPN 6,632,292 to Aegerter et al. in view of USPA 2002/0050244 to Engesser and US

2002/0162570 to Cavazza as applied to claim 1 above, and further in view of USPN 4,401,131 to Lawson et al.

50. Aegerter, Engesser, and Cavazza are relied upon as discussed above with respect to the rejection of Claim 1.

51. As to claim 15, the combination of Aegerter, Engesser, and Cavazza does not expressly disclose that at least one vibrating element is arranged to cover the area of the rotational axis.

52. Lawson discloses a transducer faceplate which is large enough to fully overlie a wafer to be cleaned, including piezoelectric transducer elements for vibration (Col. 2, lines 34-37, 58-60). If the vibrating elements cover the entirety of the wafer, they must cover the area of the rotational axis.

53. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method taught by Aegerter, Engesser, and Cavazza, to include a vibrating element arranged to cover the area of the rotational axis for the benefit of producing a uniform acoustic field across the wafer (Col. 1, lines 44-45).

54. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over USPN 6,632,292 to Aegerter et al. in view of USPA 2002/0050244 to Engesser and US 2002/0162570 to Cavazza as applied to claim 1 above, and further in view of USPN 5,788,453 to Donde et al.

55. Aegerter, Engesser, and Cavazza are relied upon as discussed above with respect to the rejection of Claim 1.

56. As to claim 16, the combination of Aegerter, Engesser, and Cavazza does not expressly disclose means for opening and closing holding elements of said holding elements of said holding means during treatment of the wafer. According to applicant's specification, means for opening and closing holding elements are defined as a tooth gear which drives eccentrically movable pins is agitated through a servomotor or each pin is driven through a magnetic or piezoelectric switch.

57. Donde discloses a system of piezoelectric grippers for holding a wafer, and which open and close to grasp a wafer, in accordance with applicant's specification (Col. 3, lines 7-9, 33-37).

58. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the apparatus taught by Aegerter, Engesser, and Cavazza to include piezoelectric grippers as taught by Donde to open and close the holding elements during treatment of a wafer. One of ordinary skill would have been motivated to add piezoelectric grippers for the benefit of reducing contamination because they can serve to grip the wafer without relative frictional motion between the gripper and the wafer, which can adversely generate contaminating particles (Col. 16, lines 1-7).

59. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over USPN 6,632,292 to Aegerter et al. in view of USPA 2002/0050244 to Engesser and US 2002/0162570 to Cavazza as applied to claim 1 above, and further in view of USPN 6,532,977 to Otsuki et al.

60. Aegerter, Engesser, and Cavazza are relied upon as discussed above with respect to the rejection of Claim 1.

61. As to claim 17, the combination of Aegerter, Engesser, and Cavazza does not expressly disclose that at least one plate at least partly comprises material having a specific sound propagation velocity deferring not more to the specific sound propagation velocity of water.

62. Otsuki discloses a cleaning vessel body made of a layer of silicon carbine, which propagates ultrasonic waves in a liquid solution (Col. 2, lines 32-42). The acoustic velocity of the ultrasonic waves propagated through the silicon carbine is 4000 to 20000 m/s. According to applicant, the sound propagation velocity of water is 1500 m/s. Therefore, this material has a sound propagation velocity deferring not more to the sound propagation velocity of water, and is suited for cleaning equipment.

63. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the apparatus taught by Aegerter, Engesser, and Cavazza to include a plate comprising a material having a sound propagation velocity deferring not more to that of water as taught by Otsuki so that sound propagation of ultrasonic waves can be increase. It is desired to increase sound propagation velocity to enhance cleaning.

64. Claims 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over USPN 6,632,292 to Aegerter et al. in view of US 2002/0162570 to Cavazza and JP 2001-009387 to Tadao (See attached machine translation).

65. As to claims 18 and 19, Aegerter discloses a method for wet-treatment of a wafer by employing the apparatus described above in the rejection of claim 1 (Col. 25, lines 38-41). This process comprises positioning and holding a single wafer between a first plate (Ref. #138) and second plate (Ref. #144) (Col. 10, lines 40-44, Col. 25, lines 10). As seen in Figure 4, the first plate (Ref. #138) can be described as having a plane A facing the wafer, thereby creating a gap of a distance d1 and the second plate (Ref. #144) can be described as having a plane C facing the wafer thereby creating a second gap of a distance d2. The wafer is held in between, parallel to both plates, which can be described as being in a plane B. Aegerter discloses spraying liquids onto the first and second surfaces of the wafer from the first and second plates such that each gap is filled with liquid (Col. 10, lines 56-63).

66. Aegerter discloses that the substrate is rotated about a rotation axis (Ref. #128) substantially perpendicular to the wafer's main surface, i.e. vertically, (Figure 4; Col. 10, line 35), but does not disclose that the wafer and second plate are relatively rotated against each other. Aegerter also does not expressly disclose applying ultrasonic energy to said second plate while less than 10% of the ultrasonic energy applied to said second plate is applied to said first plate or that each cleaning solution substantially fills each respective cleaning gap.

67. Cavazza discloses a transducer that generates ultrasonic vibrations to clean a substrate facing downward by applying ultrasonic energy to a working surface, placed under the substrate, which is applicant's claimed second plate connected to the ultrasonic transducer (Page 1, Paragraphs [0011]-[0015]; Page 3, Paragraph [0032]).

Since no ultrasonic energy is applied to the first plate, less than 10% of the ultrasonic energy applied to the second plate is applied to the first plate.

68. Tadao discloses the first and second plates rotating in a different direction than the wafer (Figure 2).

69. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method taught by Aegerter to include a vibrating element acoustically coupled to the second plate as taught by Cavazza in order to improve cleaning of the wafer. Cavazza teaches that due to the ultrasonic vibration, no particle can remain sufficiently strongly attached to the face to be treated so as to resist the liquid and gravity (Page 1, paragraph [0008]). It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the method taught by Aegerter and Cavazza to include relatively rotating the second plate and wafer against each other as taught by Tadao in order to accelerate the flow of the cleaning solutions so that cleaning efficiency is increased.

70. As to claim 20, Aegerter further discloses that the second plate (Ref. #144) has substantially the same area as the wafer (Figure 4). Therefore, it is understood that substantially all of the bottom side of the wafer, that faces the second plate, is at least temporarily covered by the second plate.

71. As to claim 21, Aegerter further discloses inserting the second liquid into a second gap from a nozzle offset to the rotation axis (Col. 23, lines 31-34).

72. Claims 22, 23, 24, 25, 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over USPN 6,632,292 to Aegerter et al. in view of USPA 2002/0050244 to Engesser , USPA 2002/0162570 to Cavazza, and USPA 20040132318 to Kim et al.

73. As to claims 22, 23, 24, and 25, Aegerter discloses an apparatus for wet-treating a wafer comprising a first plate (Ref. #138) (Col. 10, lined 41-42; Figure 4) and a first dispensing means for introducing a fluid into a first gap between said first plate and a wafer when being treated is provided in the form of a fluid supply tube (Ref. #156) with a fluid outlet nozzle (Ref. #158) (Col. 10, lines 56-60; Figure 4). The fluid supply tube extends centrally through the axis of rotation (Col. 10, lines 60-61). This structure is in accordance with the dispenser as described by applicant's specification. Aegerter discloses rotating means in the form of a rotor (Ref. #115) and rotor motor assembly (Ref. #124), in accordance with applicant's specification, are provided for rotating the work piece housing, which includes the wafer and second plate, relatively about an axis substantially perpendicular to the second plate (Col. 9, lines 62—Col. 10, line 14; Figure 4).

74. According to the specification, holding means are defined as gripping means, which are further defined as comprising movable gripping pins. Aegerter discloses wafer support members (Ref. #240) for clamping the wafers (Col. 12, lines 44-55) in the form of fasteners (Ref. #307) for holding a wafer between said first and seconds plates, substantially parallel to said plates (Col. 9, lines 52-60; Figure 1). Aegerter does not expressly disclose gripping pins in accordance with the specification. Aegerter does not expressly disclose at least one vibrating element acoustically coupled to at least said

first plate in order to direct ultrasonic waves at an angle ά of less than 89° to a wafer when treated.

75. Engesser discloses gripping means in the form of gripping pins which are movable through a mechanism (Page 3, Paragraph [0039]). The gripping pins are mounted to a mask, which corresponds to the shape of the wafer to be cleaned, and does not touch the wafer such that a gap remains, so it is understood to be applicant's claimed plate (Page 1, Paragraph [0013], [0015]).

76. Cavazza discloses a transducer that generates ultrasonic vibrations to clean a substrate facing downward (Page 1, Paragraphs [0011]-[0015]; Page 3, Paragraph [0032]). A working surface directed upward and placed under the substrate, i.e. a plate, is mechanically connected to the ultrasound transducer (Page 1, Paragraphs [0011]-[0015]), and therefore is acoustically coupled. The transducer is further coupled to a tank for holding liquid, which is applicant's intermediate liquid chamber (Page 2, Paragraph [0032]).'As the vibrations are applied to the substrate and plate through the transducer's waves generated in the chamber, the chamber is acoustically coupled to the first plate. Further, the liquid chamber contains an inlet, outlet, and pipes for supplying liquid to the chamber, which reads on applicant's claimed liquid circuit, as it circulates liquid.

77. Kim discloses adjustment-elements in the form of a positioning system (Ref. #620) that can raise, lower, or tilt the acoustic transducer (Ref. #612) (Page 4, Paragraph [0043]). It is shown that this tilting can result in the direction of ultrasonic waves at an angled of less than 89° to a wafer when treated (Figures 6, 14). The

transducer (Ref. #612) is thus placed in a slanted plane (Figures 6, 14) by the adjustment element (Page 5, Paragraph [0044]). Kim teaches that the acoustic transducer can be positioned to direct acoustic energy to either surface of the wafer (Page 5, Paragraph [0044]).

78. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the apparatus taught by Aegerter to include gripping pins and to couple the holding means and first plate to form a holding unit as taught by Engesser in order to hold the wafer. One of ordinary skill would have been motivated to use gripping pins to insure that the wafer is securely held in place during cleaning.

79. It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the apparatus taught by Aegerter and Engesser to include a vibrating element acoustically coupled to the second plate as taught by Cavazza in order to improve cleaning of the wafer. Cavazza teaches that due to the ultrasonic vibration, no particle can remain sufficiently strongly attached to the face to be treated so as to resist the liquid and gravity (Page 1, paragraph [0008]).

80. It would have been obvious to one of ordinary skill in the art to further modify the apparatus taught by Aegerter, Engesser, and Cavazza to include an adjustment element in a slanted plane as taught by Kim so that the acoustic energy being applied to the back surface of the semiconductor wafer can be controlled (Page 4, Paragraph [0043]). One of ordinary skill would have further been motivated to add a liquid chamber and circuit so that there is a constant supply of cleaning liquid in which to produce cavitation.

81. As to claim 31, Aegerter further discloses a second plate (Ref. #144) substantially parallel to the first plate (Col. 10, lined 41-42; Figure 4) and second dispensing means is similarly provided to introduce fluid into a second gap between said second plate and a wafer being treated comprising a fluid supply tube (Ref. #160) and inlet (Ref. #148) (Col. 10, lines 62-64; Figure 10).

82. Claims 26-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over USPN 6,632,292 to Aegerter et al. in view of USPA 2002/0050244 to Engesser, USPA 2002/0162570 to Cavazza, and USPA 20040132318 to Kim et al as applied to Claim 22 above, and further in view of 6, 890,390 to Azar.

83. Aegerter, Engesser, Cavazza, and Kim are relied upon as discussed above with respect to the rejection of Claim 22.

84. As to claims 26 and 27, the combination of Aegerter, Engesser, Cavazza, and Kim does not expressly disclose that the adjustment-elements comprise an array of a plurality of transducers with at least one ultrasonic generator to separately agitate said plurality of transducers in a phase-shifted way in order to generate an ultrasonic wave directed from said array of transducers at an angle of less than 89 degrees or that said array of transducers is a two dimensionally arranged plurality of transducers.

85. Azar discloses a cleaning system with a plurality of transducer elements arranged in an array which may be a matrix array (two dimensional), with a plurality of drivers (ultrasonic generator) such that each driver is connected to a transducer (Col. 3, lines 18-24; Col 7, lines 32-33). Each driver generates an electric signal such that each

transducer element separately vibrates in response to generate an ultrasonic wave (Col. 3, lines 25-30). Phase steering can be accomplished by controlling the phase of each transducer (Col. 5, lines 27-29). Azar teaches an example where an ultrasonic wave is directed at an angle of 30°, which is less than 89° (Col. 5, lines 41-42).

86. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the apparatus taught by Aegerter to include a two dimensional array of transducers as taught by Azar in order to direct ultrasonic energy onto a localized area on a substrate surface (Col. 2, lines 37-39). One of ordinary skill would have been motivated to add a plurality of transducers to uniformly clean the surface of a substrate (Col. 3, lines 10-12).

87. As to claims 28, 29, and 30, the combination of Aegerter, Engesser, Cavazza, and Kim does not expressly disclose that the quotient of the distance a of the first plate to the wafer surface facing said first plate and the mean distance d between the centers of two adjacent transducers of the array is greater than 5 (a/d>5); that the mean distance d between the centers of two adjacent transducers of the array is smaller than 2 mm; wherein the width D of the array of the transducers is at least three times as big as the distance d1 of the first plate to the wafer surface facing said plate.

88. Azar discloses the parameters of the array including the center-to-center spacing between transducer elements, the width of each element, the total aperture dimension, and the elevation dimension (Col. 5, lines 1-4). Azar teaches that the parameters of the array can be controlled to produce steering and focusing (Col. 3, lines 53-60; Col. 7, lines 26-28) It would have been obvious to one of ordinary skill at the art at the time of

the invention to modify the device taught by Aegerter to include the adjustable parameters as taught by Azar. Since the general conditions the claims are disclosed in the prior art, these optimum or workable ranges could be determined by routine experimentation in order to optimize ultrasonic cleaning (MPEP 2144.05 A).

89. Claims 32-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over USPN 6,632,292 to Aegerter et al. in view of USPA 2002/0162570 to Cavazza, USPN 6, 890,390 to Azar, and JP 2001-009387 to Tadao (See attached machine translation).

90. As to claims 32 and 33, Aegerter discloses a method for wet-treatment of a wafer by employing the apparatus described (Col. 25, lines 38-41). This process comprises holding a single wafer opposite a first plate (Ref. #138) (Col. 10, lines 40-44, Col. 25, lines 10). As seen in Figure 4, the first plate (Ref. #138) can be described as having a plane A facing the wafer, thereby creating a gap of a distance d1 and the wafer can be described as being in a plane B. Liquid is sprayed onto the first surface of the wafer from the first plates such that the gap is filled with liquid (Col. 10, lines 56-63).

91. Aegerter discloses that the substrate is rotated about a rotation axis (Ref. #128) substantially perpendicular to the wafer's main surface, i.e. vertically, (Figure 4; Col. 10, line 35), but does not disclose that the wafer and second plate are relatively rotated against each other. Aegerter also does not expressly disclose applying ultrasonic energy to said first plate so that ultrasonic energy is applied to said plane B in an angle ά of less than 89°.

92. Cavazza discloses a transducer that generates ultrasonic vibrations to clean a substrate facing downward by applying ultrasonic energy to a working surface, placed under the substrate, which is applicant's claimed second plate connected to the ultrasonic transducer (Page 1, Paragraphs [0011]-[0015]; Page 3, Paragraph [0032]). Since no ultrasonic energy is applied to the first plate, less than 10% of the ultrasonic energy applied to the second plate is applied to the first plate. Azar teaches a method of controlling the phase steering of ultrasonic cleaning with an example where an ultrasonic wave is directed at an angle of 30°, which is less than 89° (Col. 5, lines 41-42). Tadao discloses the first and second plates rotating in a different direction than the wafer (Figure 2).

93. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method taught by Aegerter to include a vibrating element acoustically coupled to the second plate as taught by Cavazza in order to improve cleaning of the wafer. Cavazza teaches that due to the ultrasonic vibration, no particle can remain sufficiently strongly attached to the face to be treated so as to resist the liquid and gravity (Page 1, paragraph [0008]). It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the method taught by Aegerter and Cavazza to include an ultrasonic wave directed at an angle of less than 89 degrees for the benefit of improved control over the ultrasonic cleaning process. It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the method taught by Aegerter, Cavazza, and Azar to include relatively

rotating the second plate and wafer against each other as taught by Tadao in order to accelerate the flow of the cleaning solution so that cleaning efficiency is increased.

94. As to claim 34, Aegerter further discloses a second plate (Ref. #144) that can be described as having a plane C facing the wafer thereby creating a second gap of a distance d2. ) (Col. 10, lines 40-44, Col. 25, lines 10).

95. As to claim 35, Aegerter further discloses that the second plate (Ref. #144) has substantially the same area as the wafer (Figure 4). Therefore, it is understood that substantially all of the bottom side of the wafer, that faces the second plate, is at least temporarily covered by the second plate.

96. As to claim 36, Aegerter does not expressly discloses that the ultrasonic energy applied to said plane B in an angle of less than 89° is generated by an array of a plurality of transducers in a phase-shifted way in order to generate an ultrasonic wave directed from said array of transducers at an angled of less than 89°.

97. Azar discloses a cleaning system with a plurality of transducer elements arranged in an array, with a plurality of drivers (ultrasonic generator) such that each driver is connected to a transducer (Col. 3, lines 18-24; Col 7, lines 32-33). Each driver generates an electric signal such that each transducer element separately vibrates in response to generate an ultrasonic wave (Col. 3, lines 25-30). Phase steering can be accomplished by controlling the phase of each transducer (Col. 5, lines 27-29). Azar teaches an example where an ultrasonic wave is directed at an angle of 30°, which is less than 89° (Col. 5, lines 41-42).

98. It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the method taught by Aegerter, Cavazza, and Tadao to include a two dimensional array of transducers as taught by Azar in order to direct ultrasonic energy onto a localized area on a substrate surface (Col. 2, lines 37-39). One of ordinary skill would have been motivated to add a plurality of transducers to uniformly clean the surface of a substrate (Col. 3, lines 10-12).

99. As to claim 37, Aegerter does not expressly disclose that the angle is varied during the wafer being treated with liquid.

100. Azar discloses that the electrical signal parameters of the transducer, including angle, can be varied during treatment with liquid (Col. 3, lines 33-34, 53-67, Col. 4, lines 1-10).

101. It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify the method taught by Aegerter, Cavazza and Tadao to include varying the angle during treatment as taught by Azar so that the ultrasonic energy can be modified according to location to maintain uniform cavitation energy (Col. 4, lines 6-10).

## ***Conclusion***

102. Any inquiry concerning this communication or earlier communications from the examiner should be directed to NAOMI BIRBACH whose telephone number is (571)270-7367. The examiner can normally be reached on Monday-Thursday, 8:00am-5:30pm.

103. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lavilla can be reached on 571-272-1539. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

104. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/N. B./
Naomi Birbach
Examiner, Art Unit 4132
1/13/2009

**/Michael La Villa/**
**Michael La Villa**
**Supervisory Patent Examiner, Art Unit 4132**
**20 January 2009**